

10/624,639

Application Number: ~~10/322,740~~

page 2

Art Unit: 2818 N/A

**Amendments to the Drawings:**

The attached sheet of drawing includes change to Fig. 1.  
This sheet replaces the corresponding original sheet.

Attachment: Replacement Sheet (one)

10/624,639

Application Number: 10/322,740  
Art Unit: 2818 N/A

page 3

REMARKS/ARGUMENTS

Applicant hereby submits a new specification including claims, which is complied with the U.S. Regulations, with a mark-up version because the English translation of the previously filed non-English specification was not complied with the U.S. Regulations. No new matter is introduced.

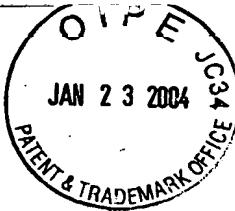
Also, applicant hereby submits a replacement drawing, Fig. 1 to correct a typing error, in which reference numeral "37a" has been corrected to --37b--. No new matter is introduced.

Respectfully submitted,

  
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[Document Name] Specification

[Title of the Invention] JOINT FOR TUBINGS

[CLAIMS]

5 What is claimed is: ( The section of claims moves to  
position before abstract )

[Claim 1]

10 1. A joint for tubings with which one end of a tubing  
inserted into an internally threaded bore of a nut member is  
externally fitted to a joint main body, an internal thread of  
said nut member being tightened against an external thread of  
the joint main body for supporting the one end of the tubing,  
wherein

15 a control ring which is externally fitted to the external  
thread of said joint main body, and which, in tightening of  
said nut member, can adjust the degree of tightening of said  
nut member, being sandwiched between a stopper portion in the  
shape of a circular flange that is formed on the rear side of  
the external thread of said joint main body and the bore  
20 peripheral face of the internally threaded bore of said nut  
member;

25 said control ring has a first end face which is brought into  
contact with the bore peripheral face of the internally  
threaded bore of said nut member, and a second end face which  
is brought into contact with the stopper portion of said joint  
main body, when said nut member is tightened; and

30 said first end face is formed such that, by making the  
friction torque which is applied to said first end face by the  
bore peripheral face of said internally threaded bore, greater  
than the friction torque which is applied to said second end  
face by said stopper portion, said nut member is turned together  
with said control ring, when said nut member is tightened.

[Claim 2]

35 2. A joint for tubings with which one end of a tubing  
inserted into an internally threaded bore of a nut member is  
externally fitted to a joint main body, an internal thread of

said nut member being tightened against an external thread of the joint main body for supporting the one end of the tubing, wherein

5 a control ring which is externally fitted to the external thread of said joint main body, and which, in tightening of said nut member, can adjust the degree of tightening of said nut member, being sandwiched between a stopper portion in the shape of a circular flange that is formed on the rear side of the external thread of said joint main body and the bore 10 peripheral face of the internally threaded bore of said nut member;

15 said control ring has a first end face which is brought into contact with the bore peripheral face of the internally threaded bore of said nut member, and a second end face which is brought into contact with the stopper portion of said joint main body, when said nut member is tightened; and

20 said first end face is formed such that, by making the coefficient of friction between said first end face and the bore peripheral face of said internally threaded bore, greater than the coefficient of friction between said second end face and said stopper portion, said nut member is turned together with said control ring, when said nut member is tightened.

Claim 3

25 3. A joint for tubings with which one end of a tubing inserted into an internally threaded bore of a nut member is externally fitted to a joint main body, an internal thread of said nut member being tightened against an external thread of the joint main body for supporting the one end of the tubing, wherein

30 a control ring which is externally fitted to the external thread of said joint main body, and which, in tightening of said nut member, can adjust the degree of tightening of said nut member, being sandwiched between a stopper portion in the shape of a circular flange that is formed on the rear side of the external thread of said joint main body and the bore 35 peripheral face of the internally threaded bore of said nut

member;

5        said control ring is formed such that, by making the friction torque which is applied by said internally threaded bore, greater than the friction torque which is applied by said stopper portion, said nut member is turned together with said control ring, when said nut member is tightened; and

10        marking portions are consecutively provided in the outer circumferential surface of said control ring at a certain interval along the direction of circumference of said outer circumferential surface.

[Claim 4]

15        4. The joint for tubings of claim 1, 2 or 3, wherein said first end face is formed along the direction of circumference of the bore peripheral face of said internally threaded bore;

the second end face is formed along the direction of circumference of said stopper portion; and

the diameter of said first end face is designed to be larger than the diameter of said second end face.

20        [Claim 5]

25        5. The joint for tubings of claim 1, 2 or 3, wherein said first end face is formed along the direction of circumference of the bore peripheral face of said internally threaded bore;

30        said second end face is formed along the direction of circumference of said stopper portion; and

35        said first end face is formed such that the total sum of the products of the components of a first reaction force which is applied to the first end face by the bore peripheral face of said internally threaded bore and the distance from the center of said control ring to the site of action of said first reaction force is larger than the total sum of the products of the components of a second reaction force which is applied to said second end face by said stopper portion and the distance from the center of said control ring to the site of action of said second reaction force.

~~[Claim 6]~~

6. The joint for tubings of claim 1, 2 or 3, wherein  
the outer circumferential surface of said control ring is  
formed such that the diameter of the outer circumferential  
5 surface is larger than the outside diameter of said nut member;  
and

said marking portions are cutouts formed in the outer  
circumferential surface of said control ring.

~~[Claim 7]~~

10 7. The joint for tubings of claim 1, 2 or 3, wherein  
said control ring is formed in the shape similar to that of  
letter C which is partially opened.

~~[Detailed Explanation of the Invention]~~

15 ~~[0001]~~

~~[Technical Field to Which the Invention Belongs]~~

FIELD OF THE INVENTION

The present invention relates to a joint for tubings with  
which one end of a tubing inserted into an internally threaded  
20 bore of a nut member is externally fitted to a joint main body,  
an internal thread of said nut member being tightened against  
an external thread of the joint main body for supporting the  
one end of the tubing. Particularly, the present invention  
relates to a plastic joint for tubings that is critical in a  
25 pipe line for pure water cleaning fluid, chemical solutions,  
and the like to be used in a clean room at the site for  
manufacturing of high-density semiconductor chips.

~~[0002]~~

~~[Prior Art]~~

30

BACKGROUND

As an example of conventional joint for tubings, that which  
is disclosed in Laid-Open Publication No. 7-243564/1995 can  
be mentioned.

35 ~~[0003]~~

With such joint for tubings, tightening the nut against the

joint main body is completed where both ends of the plastic spacer is brought into contact with the joint main body and the nut, which makes it impossible to turn the spacer by fingers, and if the nut is excessively turned beyond the tightening 5 completion position by means of a wrench or other tightening tool, the nut will press the plastic spacer to deform it, therefore, no excessive stresses will be imposed on the thread, and thus nut tightening operation can be completed without any damage being caused to the joint main body.

10 ~~{0004}~~

The same official gazette also discloses a joint for tubings with which, when both ends of the plastic spacer is brought into contact with the joint main body surface and the nut end, the difference in friction torque applied to both ends of the 15 plastic spacer causes the plastic spacer to be turned together with the nut, and the angular displacement of the outline of the plastic spacer allows the operator to visually and easily know the degree of tightening the nut and complete the tightening operation.

20 ~~{0005}~~

~~Problem to Be Solved by the Invention}~~

However, these conventional joints for tubings present a problem of that, every time the nut is slightly tightened at the final stage of nut tightening, the operator must try to 25 turn the plastic spacer by fingers to make sure that it will not turn, which makes the nut tightening operation tedious and inefficient.

In addition, there arises another problem of that, if the friction torque applied to the plastic spacer by the nut is 30 greater than the friction torque applied to the plastic spacer by the joint main body, the plastic spacer will be turned together with the nut, which indicates that the nut tightening operation may be completed, however, contrarily, if the friction torque applied to the plastic spacer by the nut is 35 smaller than the friction torque applied to the plastic spacer by the joint main body, the plastic spacer will not always be

turned together with the nut at the final stage of nut tightening, therefore, the nut may be undertightened or overtightened, resulting in a trouble, and especially with a plastic joint, the nut will be tightened as much as it is 5 tightened, unlike a metallic joint, thus the joint main body may be damaged if the nut is overtightened.

~~{0006}~~

#### SUMMARY OF THE INVENTION

10 The purpose of the present invention accomplished in consideration of the above-mentioned problems which are involved in the prior art is to provide a joint for tubings that causes the nut member and the control ring to be reliably turned together with each other at the final stage of tightening the nut member, and thus allows the proper initial tightening 15 position of the nut member to be determined, which can increase the efficiency of nut tightening operation, and prevent damage to the joint main body.

~~{0007}~~

#### ~~Means for Solving the Problems~~

20 The subject matters of the present invention to achieve the above purpose are disclosed in the following items [1] to [7]:

[1] A joint for tubings with which one end of a tubing (T) inserted into an internally threaded bore (21) of a nut member (20) is externally fitted to a joint main body (10), an internal 25 thread of said nut member (20) being tightened against an external thread (13) of the joint main body (10) for supporting the one end of the tubing (T), wherein

a control ring (30) which is externally fitted to the external thread (13) of said joint main body (10), and which, 30 in tightening of said nut member (20), can adjust the degree of tightening of said nut member (20), being sandwiched between a stopper portion (17) in the shape of a circular flange that is formed on the rear side of the external thread (13) of said joint main body (10) and the bore peripheral face (25) of the 35 internally threaded bore (21) of said nut member (20);

said control ring (30) has a first end face (32) which is

brought into contact with the bore peripheral face (25) of the internally threaded bore (21) of said nut member (20), and a second end face (34) which is brought into contact with the stopper portion (17) of said joint main body (10), when said  
5 nut member (20) is tightened; and

10 said first end face (32) is formed such that, by making the friction torque which is applied to said first end face (32) by the bore peripheral face (25) of said internally threaded bore (21), greater than the friction torque which is applied to said second end face (34) by said stopper portion (17), said nut member (20) is turned together with said control ring (30), when said nut member (20) is tightened.

~~+0008+~~

15 [2] A joint for tubings with which one end of a tubing (T) inserted into an internally threaded bore (21) of a nut member (20) is externally fitted to a joint main body (10), an internal thread of said nut member (20) being tightened against an external thread (13) of the joint main body (10) for supporting the one end of the tubing (T), wherein

20 a control ring (30) which is externally fitted to the external thread (13) of said joint main body (10), and which, in tightening of said nut member (20), can adjust the degree of tightening of said nut member (20), being sandwiched between a stopper portion (17) in the shape of a circular flange that  
25 is formed on the rear side of the external thread (13) of said joint main body (10) and the bore peripheral face (25) of the internally threaded bore (21) of said nut member (20);

30 said control ring (30) has a first end face (32) which is brought into contact with the bore peripheral face (25) of the internally threaded bore (21) of said nut member (20), and a second end face (34) which is brought into contact with the stopper portion (17) of said joint main body (10), when said nut member (20) is tightened; and

35 said first end face (32) is formed such that, by making the coefficient of friction between said first end face (32) and the bore peripheral face (25) of said internally threaded bore

(21), greater than the coefficient of friction between said second end face (34) and said stopper portion (17), said nut member (20) is turned together with said control ring (30), when said nut member (20) is tightened.

5        ~~{0009}~~

[3] A joint for tubings with which one end of a tubing (T) inserted into an internally threaded bore (21) of a nut member (20) is externally fitted to a joint main body (10), an internal thread of said nut member (20) being tightened against an 10 external thread (13) of the joint main body (10) for supporting the one end of the tubing (T), wherein

15        a control ring (30) which is externally fitted to the external thread (13) of said joint main body (10), and which, in tightening of said nut member (20), can adjust the degree of tightening of said nut member (20), being sandwiched between a stopper portion (17) in the shape of a circular flange that is formed on the rear side of the external thread (13) of said joint main body (10) and the bore peripheral face (25) of the internally threaded bore (21) of said nut member (20);

20        said control ring (30) is formed such that, by making the friction torque which is applied by said internally threaded bore (21), greater than the friction torque which is applied by said stopper portion (17), said nut member (20) is turned together with said control ring (30), when said nut member (20) 25 is tightened; and

marking portions (36) are consecutively provided in the outer circumferential surface (38) of said control ring (30) at a certain interval along the direction of circumference of said outer circumferential surface (38).

30        ~~{0010}~~

[4] The joint for tubings as stated in item [1], item [2] or item [3], wherein

35        said first end face (32) is formed along the direction of circumference of the bore peripheral face (25) of said internally threaded bore (21);

the second end face (34) is formed along the direction of

circumference of said stopper portion (17); and  
the diameter of said first end face (32) is designed to be  
larger than the diameter of said second end face (34).

+0011]

5 [5] The joint for tubings as stated in item [1] , item [2]  
or item [3], wherein

said first end face (32) is formed along the direction of  
circumference of the bore peripheral face (25) of said  
internally threaded bore (21);

10 said second end face (34) is formed along the direction of  
circumference of said stopper portion (17); and

said first end face (32) is formed such that the total sum  
of the products of the components of a first reaction force  
which is applied to the first end face (32) by the bore  
15 peripheral face (25) of said internally threaded bore (21) and  
the distance from the center of said control ring (30) to the  
site of action of said first reaction force is larger than the  
total sum of the products of the components of a second reaction  
force which is applied to said second end face (34) by said  
20 stopper portion (17) and the distance from the center of said  
control ring (30) to the site of action of said second reaction  
force.

+0012]

25 [6] The joint for tubings as stated in item [1] , item [2]  
or item [3], wherein

the outer circumferential surface (38) of said control ring  
(30) is formed such that the diameter of the outer  
circumferential surface (38) is larger than the outside  
diameter of said nut member (20); and

30 said marking portions (36) are cutouts (36) formed in the  
outer circumferential surface (38) of said control ring (30).

+0013]

[7] The joint for tubings as stated in item [1] , item  
[2] or item [3], wherein

35 said control ring (30) is formed in the shape similar to  
that of letter C which is partially opened.

~~{0014}~~

Next, the function of the present invention will be described.

By inserting one end of the tubing (T) into the internally threaded bore (21) of the nut member (20), externally fitting the one end of the tubing (T) to the joint main body (10), and tightening the internal thread (23) of the nut member (20) against the external thread (13) of the joint main body (10), the one end of the tubing (T) is supported. The control ring (30) is kept externally fitted to the external thread (13) of the joint main body (10).

~~{0015}~~

When the nut member (20) is tightened, the control ring (30) is sandwiched between the stopper portion (17) of the joint main body (10) and the bore peripheral face (25) of the internally threaded bore (21) of the nut member (20), and then the first end face (32) of the control ring (30) is contacted with the bore peripheral face (25) of the internally threaded bore (21) of the nut member (20), the second end face (34) of the control ring (30) being contacted with the stopper portion (17) of the joint main body (10).

~~{0016}~~

The first end face (32) and the second end face (34) are formed such that, in tightening the nut member (20), the friction torque which is applied to the first end face (32) by the bore peripheral face (25) of the internally threaded bore (21) is greater than the friction torque which is applied to the second end face (34) by the stopper portion (17), therefore, the nut member (20) is caused to be turned together with the control ring (30). Such co-turning is a phenomenon which occurs when the degree of tightening of the nut member (20) reaches a proper level, and by identifying the angle through which the co-turning has been performed, before completing the operation of tightening the nut member (20), the proper initial tightening position of the nut member (20) can be determined; the tightening operation for the nut member

(20) can be performed simply and reliably; occurrence of a trouble due to undertightening or overtightening of the nut member (20) can be prevented; and particularly, damage to the joint main body (10) resulting from overtightening can be 5 avoided.

{0017}

Specifically, when forming the first end face (32) along the direction of circumference of the bore peripheral face (25) of the internally threaded bore (21), and forming the second 10 end face (34) along the direction of circumference of the stopper portion (17), the diameter of the first end face (32) may be designed to be larger than the diameter of the second end face (34). By doing so, the site of action of a first reaction force which is applied to the first end face (32) by 15 the bore peripheral face (25) of the internally threaded bore (21) is set more distantly from the turning center of the control ring (30) than the site of action of a second reaction force which is applied to the second end face (34) by the stopper portion (17). Because the first reaction force is equal to 20 the second reaction force on the relationship between the action and the reaction, the friction torque based on the first reaction force is greater than the friction torque based on the second reaction force. Therefore, in tightening the nut member (20), the nut member (20) and the control ring (30) are 25 caused to be turned together with each other.

{0018}

Alternatively, the first end face (32) may be formed such that the total sum of the products of the components of a first reaction force which is applied to the first end face (32) by 30 the bore peripheral face (25) of the internally threaded bore (21) and the distance from the center of the control ring (30) to the site of action of the first reaction force is larger than the total sum of the products of the components of a second reaction force which is applied to the second end face (34) 35 by the stopper portion (17) and the distance from the center of the control ring (30) to the site of action of the second

reaction force.

~~[0019]~~

As described above, co-turning can be embodied by specifying the geometries and positions of the first end face 5 (32) and the second end face (34), however, the respective materials for the control ring (30) and the joint main body (10) may be appropriately selected for making the coefficient of friction between the first end face (32) and the bore peripheral face (25) of the internally threaded bore (21), 10 greater than the coefficient of friction between the second end face (34) and the stopper portion (17), thereby allowing the nut member (20) to be turned together with the control ring (30), when the nut member (20) is tightened.

~~[0020]~~

15 The nut member (20) starting to turn together with the control ring (30) indicates that the degree of the nut member (20) being tightened has reached a proper level, however, in order to perform the tightening operation for the nut member 20 (20) more reliably, it is necessary to identify the angle through which the nut member (20) and the control ring (30) has been turned together with each other. For this, marking portions (36) may be consecutively provided in the outer circumferential surface (38) of the control ring (30) at a certain interval along the circumferential direction. In 25 co-turning, the marking portions (36) are turned together with the control ring (30), and by examining the angle through which the marking portions (36) have been turned, the angle through which the nut member (20) and the control ring (30) have been turned together with each other can be easily known.

30 ~~[0021]~~

The control ring (30) is sandwiched between the nut member (20) and the stopper portion (17) of the joint main body (10), and thus tends to be covered by them, the marking portions (36) tending to be difficult to be viewed, which may make it 35 impossible to easily identify the angle through which the co-turning has been performed.

~~[0022]~~

Then, first, the outer circumferential surface (38) providing a circumference for the first end face (32) is formed such that the diameter of the outer circumferential surface 5 (38) is larger than the outside diameter of the nut member (20), then, cutouts (36) may be consecutively given in the outer circumferential surface (38) of the first end face (32) at a certain interval along the circumferential direction. By doing so, the cutouts (36) are made conspicuous, being not 10 covered by said both, which allows easily knowing the angle through which the co-turning has been performed.

~~[0023]~~

The control ring (30) is generally of a closed annular shape, however, it may be in the shape similar to that of letter C 15 which is partially opened. By forming the control ring (30) in the shape similar to that of letter C, the control ring (30) can be easily removed from the clearance between the nut member (20) and the stopper portion (17) of the joint main body (10) after completion of the tightening operation for the nut member 20 (20). In addition, the partially opened portion of the control ring (30) can be used as a marking portion (36) for identifying the angle through which the co-turning has been performed.

~~[0024]~~

~~[Mode of Operation of the Invention]~~

25 DESCRIPTION OF THE PREFERRED EMBODIMENTS

Hereinbelow, one embodiment of the present invention will be described with reference to the drawings. The drawings show the one embodiment of the present invention. Fig. 1 is a sectional view of the critical portion of a joint for tubings 30 according to the one embodiment of the present invention. Fig. 2 is a view of a control ring according to the same embodiment that is taken in the direction of the arrow II in Fig. 1, and Fig. 3 is a view of the control ring that is taken in the direction of the arrow III in Fig. 1.

35 ~~[0025]~~

As shown in Fig. 1 to Fig. 3, the joint for a tubing T

comprises a joint main body 10, which is made of a fluorocarbon resin, and a nut member 20, which is also made of a fluorocarbon resin. As the fluorocarbon resin, PTFE (polytetrafluoroethylene) and PFA (tetrafluoroethylene-perfluoroalkilvinyl ether copolymer), which are excellent in chemical resistance, can be mentioned.

~~+0026}~~

The nut member 20 is a so-called cap nut, having an innermost recess wall 22 on the rear side of an internally threaded bore 21 thereof, which provides the bottom of the threaded bore that is approximately orthogonal to the thread axis. On the front side of the internally threaded bore 21 of the nut member 20, an internal thread 23 is provided, and in the innermost recess wall 22 of the nut member 20, an insertion hole 24 for inserting a tubing into the internally threaded bore 21 from the innermost recess wall 22 is provided.

~~+0027}~~

The nut member 20 is provided with a tightened portion 27 having an approximately hexagonal section to which a nut tightening tool (wrench) can be fitted. In the joint main body 10, an externally fitted portion 12 is formed in an end portion 11 which is inserted into the rear of the internally threaded bore 21 of the nut member 20. To the externally fitted portion 12, one end of the tubing T which is inserted into the internally threaded bore 21 through the insertion hole 24 of the nut member 20 is fitted with the diameter being expanded. Therefore, the one end of the tubing T which is inserted into the internally threaded bore 21 comprises a general outside diameter portion T1, a larger diameter expanded portion T2, which is externally fitted to the externally fitted portion 12, and a shoulder portion T3 (or flare), which is an intermediate portion connecting between the general outside diameter portion T1 and the expanded diameter portion T2.

~~+0028}~~

In the end portion 11 of the joint main body 10, an external thread 13, which is engaged with the internal thread 23, is

provided, following the externally fitted portion 12. The diameter of the thread of the internal thread 23 of the nut member 20, which is engaged with the external thread 13, and the diameter of the bore inner circumferential wall 21a of the 5 internally threaded bore 21 of the nut member 20 are designed to be slightly larger than the outside diameter of the expanded diameter portion T2 such that the expanded diameter portion T2 of the tubing T can be relatively inserted, and the diameter of the thread and the like is at minimum.

10 ~~10029~~

On the rear side of the external thread 13 of the joint main body 10, a stopper portion 17 having an approximately hexagonal section is provided. The base end portion of the joint main body 10 forms an elbow portion which is L-shaped bent. In the 15 joint main body 10, a through-hole 14, which passes through along the thread axis, having approximately the same diameter as the bore diameter of the tubing T, is provided.

~~10030~~

With the present embodiment, the base portion of the joint 20 main body 10 forms an elbow portion, however, being not limited to this, the base portion of the joint main body 10 may be straight rather than L-shaped bent, or the through-hole 14 may be formed in the shape of T.

~~10031~~

25 When the end portion 11 of the joint main body 10 is inserted into the rear of the internally threaded bore 21 of the nut member 20, the innermost recess wall 22 of the nut member 20 is opposed to a lip portion 15 of the through-hole 14 of the joint main body 10 in the direction parallel to the thread axis. 30 The outer peripheral edge of the lip portion 15 of the through-hole 14 is provided with a chamfered portion 19 such that the one end of the tubing T can be externally fitted with ease, and a stable airtightness can be maintained. The inner peripheral edge of the lip portion 15 is provided with a 35 chamfered portion 19a for prevention of accumulation of liquid, which is a moving medium.

{0032}

The externally fitted portion 12 of the end portion 11 of the joint main body 10, to which the one end of the tubing T is externally fitted, is provided with a sufficient wall 5 thickness and the required rigidity for minimizing the deformation in the direction of diameter reduction resulting from the tightening force of the nut member 20 in order to prevent the sealing ability from being lowered. On the other hand, the innermost recess wall 22 of the nut member 20 is formed 10 as a biting portion 22a which is directed toward the center line of the insertion hole 24 (center of the thread axis), being inclined at a defined angle (25 deg to 35 deg) toward the lip portion 15 of the through-hole 14 of the joint main body 10 (toward the front side of the internally threaded bore).

15 {0033}

When tightening the nut member 20, the external thread 13 of the joint main body 10 is externally fitted with a control ring 30. The control ring 30 is formed in the shape similar to that of C letter which is partially opened. The opened portion 39 thereof is externally fitted from the direction orthogonal to the thread axis of the external thread 13 of the joint main body 10. The control ring 30 is sandwiched between the stopper portion 17 of the joint main body 10 and the bore peripheral face of the internally threaded bore 21 of the nut member 20, allowing the degree of tightening of the nut member 20 to be adjusted.

{0034}

As the material of the control ring 30, a synthetic resin, such as polypropylene resin, polyethylene resin, and polyvinyl chloride, is used. A fluorocarbon resin, such as PVF, PVDF, ECTFE, PCTFE, ETFE, FEP, PFA, and PTFE, may also be used.

{0035}

The control ring 30 has a first end face 32, which is brought into contact with the bore peripheral face 25 of the internally threaded bore 21 of the nut member 20, and a second end face 34, which is brought into contact with the stopper portion 17

of the joint main body 10, when the nut member 20 is tightened.

~~+0036~~

The first end face 32 is formed such that, by making the friction torque which is applied to the first end face 32 by the bore peripheral face 25 of the internally threaded bore 21, greater than the friction torque which is applied to the second end face 34 by the stopper portion 17, the nut member 20 is turned together with the control ring 30, when the nut member 20 is tightened.

10 ~~+0037~~

Specifically, the first end face 32 is formed along the direction of circumference of the bore peripheral face 25 of the internally threaded bore 21, and the second end face 34 is formed along the direction of circumference of the stopper portion 17, with the diameter  $D_1$  of the first end face 32 being designed to be larger than the diameter  $D_2$  of the second end face 34. Assuming that the width of the first end face 32 is  $W_1$ , and the width of the second end face 34 is  $W_2$ , the contact area  $S_1$  (the hatched area in Fig. 2) where the first end face 32 is contacted with the bore peripheral face 25 of the internally threaded bore 21 is approximately equal to  $\pi D_1 \cdot W_1$ , and the contact area  $S_2$  (the hatched area in Fig. 3) where the second end face 34 is contacted with the stopper portion 17 is approximately equal to  $\pi D_2 \cdot W_2$ .

25 ~~+0038~~

In the second end face 34 of the control ring 30, a shoulder portion 35 is formed. The shoulder portion 35 is located in the larger diameter portion of the second end face 34, being retracted from the stopper portion 17 such that the shoulder portion 35 is not contacted with the stopper portion 17. As a result of this, the portion of the second end face 34 where the second end face 34 is contacted with the stopper portion 17 has a diameter smaller than that of the shoulder portion 35. In the inner circumferential surface 37 of the control ring 30, a first inner circumferential surface 37a and a second inner circumferential surface 37b are formed such that they

are externally fitted to the external thread 13 and the neck portion 13a thereof (a portion having a diameter smaller than that of the external thread 13), respectively.

~~{0039}~~

5 Next, the function of the present embodiment will be described.

One end of the tubing T is inserted into the internally threaded bore 21 through the insertion hole 24 of the nut member 20, and the expanded diameter portion T2 of the one end of the 10 tubing T is externally fitted to the externally fitted portion 12 of the end portion 11 of the joint main body 10. The shoulder portion T3, which connects between the general outside diameter portion T1 and the expanded diameter portion T2 of the tubing T, is flared along the chamfered portion 19 of the externally 15 fitted portion 12 of the joint main body 10. When the end portion 11 of the joint main body 10 is advanced toward the rear side of the internally threaded bore 21 of the nut member 20, the starting end of the external thread 13 of the joint main body 10 is contacted with the starting end of the internal thread 23 of the nut member 20. Then, the expanded diameter portion T2 of the tubing T is relatively advanced with a slight clearance being retained between it and the internally threaded bore 21 (the thread of the internal thread 23 or the bore inner circumferential wall 21a of the internally threaded bore 21) 25 of the nut member 20, or while slide contacting with the internally threaded bore 21.

~~{0040}~~

By fitting a tightening tool to the tightened portion 27 of the nut member 20, and also fitting a tightening tool to the stopper portion 17 of the joint main body 10, and then by 30 relatively turning these tools, the internal thread 23 of the nut member 20 is advanced, being engaged with the external thread 13 of the joint main body 10. With the internal thread 23 of the nut member 20 being fully engaged with the external 35 thread 13 of the joint main body 10, the biting portion 22a of the innermost recess wall 22 of the nut member 20 bites the

shoulder portion T3 of the tubing T, thus preventing the tubing T from being dropped off. Further, the tubing T and the chamfered portion 19 of the joint main body 10 are pressed against each other, which results in a high airtightness being obtained.

~~{0041}~~

By inserting one end of the tubing T into the internally threaded bore 21 of the nut member 20, externally fitting the one end of the tubing T to the joint main body 10, and tightening the internal thread 23 of the nut member 20 against the external thread 13 of the joint main body 10, the one end of the tubing T is supported. The control ring 30 is kept externally fitted to the external thread 13 of the joint main body 10.

~~{0042}~~

Before starting the operation of tightening the nut member 20, the opened portion 39 of the control ring 30 is externally fitted to the external thread 13 from the direction orthogonal to the thread axis of the external thread 13 of the joint main body 10. Then, when the internal thread 23 of the nut member 20 is tightened against the external thread 13 of the joint main body 10, the control ring 30 is sandwiched between the stopper portion 17 of the joint main body 10 and the bore peripheral face 25 of the internally threaded bore 21 of the nut member 20, and then the first end face 32 of the control ring 30 is contacted with the bore peripheral face 25 of the internally threaded bore 21 of the nut member 20, the second end face 34 of the control ring 30 being contacted with the stopper portion 17 of the joint main body 10.

~~{0043}~~

In tightening the nut member 20, the friction torque which is applied to the first end face 32 by the bore peripheral face 25 of the internally threaded bore 21 is greater than the friction torque which is applied to the second end face 34 by the stopper portion 17, which causes the nut member 20 to be turned together with the control ring 30, allowing the degree of tightening of the nut member 20 to be adjusted properly.

~~10044~~

Specifically, because the diameter of the first end face 32 is designed to be larger than the diameter of the second end face 34, the site of action of a first reaction force which 5 is applied to the first end face 32 by the bore peripheral face 25 of the internally threaded bore 21 is more distant from the turning center of the control ring 30 than the site of action of a second reaction force which is applied to the second end face 34 by the stopper portion 17.

10 ~~10045~~

Assuming that the first reaction force and the second reaction force are  $F_1$  and  $F_2$ , respectively, the distance from the turning center of the control ring 30 to the site of action of the first reaction force  $F_1$  and the second reaction force 15  $F_2$  are  $R_1$  and  $R_2$ , respectively, and the coefficients of friction for the first end face 32 and the second end face 34 are both  $\mu$ , the friction torque based on the first reaction force is  $\sum \mu F_1 \cdot R_1$ , and the friction torque based on the second reaction force is  $\sum \mu F_2 \cdot R_2$ .

20 ~~10046~~

Here, the coefficient of friction,  $\mu$ , is a coefficient of static friction; the friction torque based on the first reaction force  $F_1$  is the total sum of the products of the components of the first reaction force  $F_1$  which is applied to 25 the first end face 32 by the bore peripheral face 25 of the internally threaded bore 21 and the distance  $R_1$  from the center (the turning center) of the control ring 30 to the site of action of the first reaction force  $F_1$ ; and the friction torque based on the second reaction force  $F_2$  is the total sum of the products 30 of the components of the second reaction force  $F_2$  which is applied to the second end face 34 by the stopper portion 17 and the distance  $R_2$  from the center of the control ring 30 to the site of action of the second reaction force  $F_2$ .

~~10047~~

35 In tightening the nut member 20, the first reaction force is equal to the second reaction force ( $F_1 = F_2$ ) on the

relationship between the action and the reaction, and because R1 > R2, the friction torque based on the first reaction force ( $\sum \mu F_1 \cdot R_1$ ) is greater than the friction torque based on the second reaction force ( $\sum \mu F_2 \cdot R_2$ ), resulting in the second end face 34 earlier starting to slip with respect to the stopper portion 17, whereby, in tightening the nut member 20, the nut member 20 and the control ring 30 are caused to be turned together with each other.

~~{0048}~~

By completing the operation of tightening the nut member 20 after confirming that the nut member 20 is turned together with the control ring 30, the proper initial tightening position of the nut member 20 can be determined, which allows the tightening operation for the nut member 20 to be performed simply and reliably. In addition, troubles due to undertightening or overtightening the nut member 20 can be prevented, and especially, damage to the joint main body 10 resulting from overtightening the nut member 20 can be avoided.

~~{0049}~~

Further, when the nut member 20 is turned together with the control ring 30, the opened portion 39 of the control ring 30 provides a marking which allows identifying the angular position reached as a result of the nut member 20 and the control ring 30 being turned together with each other, whereby the operation of tightening the nut member 20 can be performed more reliably.

~~{0050}~~

Once the operation of tightening the nut member 20 is completed, the joint for tubings can be in service, however, the force supporting the tubing may be reduced by the use over a long period of time, therefore, after the service over a certain period of time, the nut member 20 must be retightened to prevent the reduction in supporting force. Before retightening the nut member 20, the control ring 30 must be removed from the external thread 13 of the joint main body 10. In such a case, by relatively passing the external thread 13

of the joint main body 10 through the clearance between the edges of the opened portion 39 of the control ring 30, the control ring 30 can be easily removed from the external thread 13 of the joint main body 10.

5        ~~{0051}~~

On the other hand, when retightening the nut member 20, a control ring 30 for retightening may be placed in the clearance between the nut member 20 and the stopper portion 17. Also in retightening the nut member 20 with the control ring 30 for 10 retightening, the nut member 20 and the control ring 30 must be set such that they are turned together with each other, without fail.

10        ~~{0052}~~

In the above-stated embodiment, the diameter of the first 15 end face 32 of the control ring 30 is designed to be larger than that of the second end face 34, and thus the nut member 20 and the control ring 30 are surely turned together with each other, however, assuming that the coefficients of friction for the first end face 32 and the second end face 34 are  $\mu_1$  and 20  $\mu_2$  (where  $\mu_1 > \mu_2$ ), respectively, the friction torque based on the first reaction force ( $\sum \mu_1 \cdot F_1 \cdot R_1$ ) is greater than the friction torque based on the second reaction force ( $\sum \mu_2 \cdot F_2 \cdot R_2$ ), even if  $R_1 = R_2$ , whereby, in tightening the nut member 20, the nut member 20 and the control ring are turned together 25 with each other.

25        ~~{0053}~~

Further, as shown in Fig. 4 to Fig. 6 (B), marking portions are consecutively provided in the outer circumferential surface 38 of the control ring 30 at a certain interval along 30 the circumferential direction. Specifically, in the outer circumferential surface 38 which provides a circumference for the first end face 32, and has a diameter larger than the outside diameter of the nut member 20, cutouts 36 as marking portions may be consecutively given in the outer circumferential surface 35 38 at a certain interval along the circumferential direction.

38        ~~{0054}~~

When the nut member 20 and the control ring 30 are turned together with each other, the cutouts 36 are turned integrally with the control ring 30. Specifically, the condition of the cutouts 36 is changed over from that before the occurrence of 5 co-turning, which is shown in Fig. 6 (A), to that after the occurrence of co-turning, which is shown in Fig. 6 (B). By examining the angle through which the cutouts 36 have been turned (approx. 45 deg in Fig. 6 (A) and Fig. 6 (B)), the angle through which the nut member 20 and the control ring 30 have 10 been turned together with each other can be easily known. Further, by providing the cutouts 36 in the outer circumferential surface 38 having a diameter larger than the outside diameter of the nut member 20, the cutouts 36 are made conspicuous, being not covered by the nut member 20 and the 15 stopper portion 17, which allows easily knowing the angle through which the co-turning has been performed.

~~+0055}~~

Fig. 7 and Fig. 8 show a variant of the above-stated embodiment, Fig. 7 being a front view of the control ring, and 20 Fig. 8 being a sectional view taken on line VIII-VIII in Fig. 7. Fig. 9 and Fig. 10 show another variant of the above-stated embodiment, Fig. 9 being a front view of the control ring, and Fig. 10 being a sectional view taken on line X-X in Fig. 9.

~~+0056}~~

25 As shown in Fig. 7 to Fig. 10, the second end face 34 has no shoulder portion 35 as is the case with the above-stated embodiment. With these control rings 30, the largest diameters of the first end face 32 and the second end face 34 are approximately equal to each other, while the smallest 30 diameter of the first end face 32 is larger than the smallest diameter of the second end face 34. Therefore, the first reaction force from the bore peripheral face 25 of the internally threaded bore 21 is applied to the first end face 32 of the control ring 30 more concentratedly than to the second 35 end face 34.

~~+0057}~~

Therefore, the friction torque based on the first reaction force is greater than the friction torque based on the second reaction force, which results in the second end face 34 earlier starting to slip with respect to the stopper portion 17, whereby, 5 in tightening the nut member 20, the nut member 20 and the control ring 30 are caused to be turned together with each other.

{0058}

~~Effects of the Invention~~

10 As described above, with the joint for tubings according to the present invention, the friction torque which is applied to the first end face by the bore peripheral face of the internally threaded bore of the nut member is greater than the friction torque which is applied to the second end face by the 15 stopper portion of the joint main body, in tightening the nut member, therefore, the nut member is caused to be turned together with the control ring at the final stage of tightening the nut member, which allows the proper initial tightening position of the nut member to be determined, the efficiency 20 of nut tightening operation to be improved, and damage to the joint main body to be prevented.

\*図面の説明部分(P.24.25行目～P.25.21行目)

~~Brief Explanation of the Drawings~~

DESCRIPTION OF THE PREFERRED EMBODIMENT  
(P.13.25行目)の前2行移動。

~~FIG. 1~~

25 BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a sectional view of the critical portion of a joint for tubings according to one embodiment of the present invention;

~~FIG. 2~~

30 Fig. 2 is a view of a control ring according to the one embodiment of the present invention that is taken in the direction of the arrow II in Fig. 1;

~~FIG. 3~~

Fig. 3 is a view of the control ring according to the one 35 embodiment of the present invention that is taken in the direction of the arrow III in Fig. 1;

[FIG. 4]

Fig. 4 is a front view of a control ring according to another embodiment of the present invention;

[FIG. 5]

5 Fig. 5 is a sectional view taken on line V-V in Fig. 4;

[FIG. 6]

10 Fig. 6 (A) and Fig. 6 (B) are explanatory drawings showing the conditions of the control ring according to the another embodiment of the present invention before and after co-turning of the control ring, Fig. 6 (A) showing the condition before co-turning, and Fig. 6 (B) showing the condition after;

[FIG. 7]

Fig. 7 is a front view of a control ring according to a variant of the embodiment of the present invention;

15 [FIG. 8]

Fig. 8 is a sectional view taken on line VIII-VIII in Fig. 7;

[FIG. 9]

Fig. 9 is a front view of a control ring according to another variant of the embodiment of the present invention; and

20 [FIG. 10]

Fig. 10 is a sectional view taken on line X-X in Fig. 9.

{Name of Document} ABSTRACT

{Abstract}

{Problem} A joint for tubings which allows the efficiency of nut tightening operation to be improved, and damage to the joint main body to be prevented must be provided.

5 {Means to Solve the Problem} A joint for tubings with which, in tightening the nut member 20, the friction torque applied to the first end face 32 of the control ring 30 by the bore peripheral face 25 of the internally threaded bore 21 of the 10 nut member 20 is greater than the friction torque applied to the second end face 34 of the control ring 30 by the stopper portion 17 of the joint main body 10, and thus the nut member 20 is reliably turned together with the control ring 30 at the 15 final stage of tightening the nut member 20, which allows the proper initial tightening position of the nut member 20 to be determined.